



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification 5 :</b> <b>F16B 7/18, E21B 17/04, 17/042</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 90/11455</b> <b>(43) International Publication Date:</b> 4 October 1990 (04.10.90)
<b>(21) International Application Number:</b> PCT/AU90/00113 <b>(22) International Filing Date:</b> 20 March 1990 (20.03.90) <b>(30) Priority data:</b> PJ 3394 28 March 1989 (28.03.89) AU <b>(71) Applicant (for all designated States except US):</b> WALLIS INDUSTRIES PTY. LTD. [AU/AU]; 54 Beaconsfield Avenue, Midvale, W.A. 6056 (AU). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> EATON; Ronald, Edmond [AU/AU]; 22 Hale Road, Forrestfield, W.A. 6058 (AU). <b>(74) Agents:</b> HARWOOD, Errol, John et al.; Wray & Associates, P.O. Box 6292, East Perth, W.A. 6004 (AU).		<b>(81) Designated States:</b> AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), + CH, CH (European patent), CM (OAPI patent), DE, + DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> COUPLING  <div style="text-align: center;"> </div> <b>(57) Abstract</b> <p>A coupling means for fixing a male member (11) of substantially circular cross section to a female member (12) of complementary configuration, one of said members is formed with a helical groove (13) to be in opposed relation to a correspondingly configured helical formation (14) on the other member when the members are inter-engaged, a plurality of locking elements (15) of substantially complementary configuration to the profile of the helical groove (13) and helical formation (14) are receivable between the helical formation (14) and the helical groove (13) on engagement of the male and female members (11, 13).</p>		

### DESIGNATIONS OF "DE"

Until further notice, any designation of "DE" in any international application whose international filing date is prior to October 3, 1990, shall have effect in the territory of the Federal Republic of Germany with the exception of the territory of the former German Democratic Republic.

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COUPLING

THIS INVENTION relates to a coupling and in particular a coupling means for fixing a male member to a female member.

In one form the invention resides in a coupling means for fixing a male member of substantially circular cross-section to a female member of complementary configuration, one of said members being formed with a helical groove to be in opposed relation to a correspondingly configured helical formation on the other member when the members are inter-engaged, a plurality of locking elements of substantially complementary configuration to the profile of the helical groove and helical formation being receivable between the helical formation and the helical groove on engagement of the male and female members.

According to one embodiment the helical formation comprises a helical array of apertures.

According to another embodiment the helical formation is formed as a continuous helical recess terminating short of the end/or ends of the one member.

According to a further embodiment the helical formation comprises a set of groove shaped recesses.

In each of the embodiments each locking element may be shaped as a ball.

In each of the embodiments the locking element may be cubic in shape.

In each of the embodiments the locking element may be substantially cylindrical in shape.

SUBSTITUTE SHEET

According to a preferred feature a set screw is receivable in the female member to be engagable with one or more locking elements received between the helical groove and the helical formation and the members are substantially fully engaged to clampingly engage the locking element between the male and female members.

The invention will be more fully understood in the light of the following description of several specific embodiments.

The description is made with reference to the accompanying drawings of which;

Figure 1 is a side elevation of a male member according to the first embodiment;

Figure 2 is a sectional side elevation of a female member of the first embodiment;

Figure 3 is a sectional side elevation of the male and female members when inter-engaged;

Figure 4 is a side elevation of a male member according to the second embodiment; and

Figure 4 is a side elevation of a female member according to the third embodiment.

Each of the embodiments relates to a means for effecting a coupling between two components which is intended to supplement and/or replace the conventional threaded interconnection which is used between a male and female member of complementary configuration. In instances where a threaded interconnection is required for a component

which is involved in a transmission of large impact and/or torsional forces a threaded connection can provide the most effective interconnection, however by the nature of its inter-engagement and the high frictional forces which are established between the members, several difficulties can be experienced when it becomes necessary to separate the two components.

The first embodiment provides a male member 11 and a female member 12 of complementary configuration. The female member is formed with a helical groove 13 which has a part circular profile. The male member is formed with a helical formation in the form of a helical array of recesses 14. Each recess has a part spherical configuration. The helical array of recesses is complementary in its pitch to the helical groove 13 provided on the male member. Each of the recesses 14 receives a ball 15 having a configuration conforming to the profile of the recess and of the helical groove 13. The recesses 14 have a depth of less than the diameter of the balls in order that a portion of the surface of a ball received within a recess will extend beyond the surface of the male member. On engagement of the male member 11 with the female member 12, the first recess to enter the female member is aligned with the entry to the helical groove 13 and a ball 15 is engaged therewith in order to enter the groove. With further engagement of the male member relative rotation is produced between the male and female member in order that the first ball 15 travels along the helical groove until the next recess is located at the entry of the helical groove 13 at which time a second ball 15 is located in the next recess. This action is repeated until the engagement between the male and female members is completed.

If desired the female member may be associated with a set screw (not shown) which is threadably received in an aperture provided in the wall of the female member which is in alignment with one of the recesses when the male and female members are fully engaged. The engagement of the set screw with the ball located in the respective recess produces a clamping engagement of the ball between the male and female members to frictionally lock the members together.

In the case of the second embodiment as shown at Figure 4 the helical formation on the male member may take the form of a continuous helical groove shaped recess 114 of corresponding pitch to the helical groove on the female member but of a fixed length and which terminates short of the end of the male member. On engagement of the male member 111 with the respective female member (not shown) the adjacent end of the helical recess is aligned with the entry to the helical groove provided in the female member and a ball is located therebetween. On further engagement of the male member with the female member and on relative rotation between the male member and female member additional balls are inserted into the space between the helical groove and helical recess until the helical recess is fully received in the male member.

As in the case of the first embodiment, if desired a set screw can be threadably received through an aperture in the wall of the female member to be in alignment with the helical groove and helical recess when the male and female members are fully engaged. The set screw is thus engagable with one or more of the balls located between the male and female members to clampingly engage the ball between those members and thus frictionally lock the members together.

In the case of the third embodiment as shown at Figure 5 the helical formation takes the form of a series of helically disposed groove shaped recesses 214 which together define a helical formation of complementary configuration to the helical groove in the female member (not shown). On engagement of the male member 211 with a respective female member and as each recess 215 is brought into engagement with the entry of the helical groove provided in the female member an appropriate number of balls are located in the space therebetween on relative rotation between the male and female member such that the spaces so formed are substantially filled with such balls. This process is completed until the male members and the female members are fully inter-engaged. As in the case in the previous embodiment a set screw may be provided in the female member to clampingly engage one or more of the balls accommodated between the male and female members.

It should be appreciated that in the case of each of the above embodiments that if desired the balls as described may be substituted by any suitable regularly shaped element. For example the element may be cylindrical in shape and the configuration of the helical formation be such that the elements are received such that their central axes are substantially radially directed with respect to the male member. As a result the helical groove provided in the female member has a substantially square shaped profile to snugly receive the exposed ends of the locking elements. Alternatively, in the case of a locking element having a substantially cylindrical configuration the locking elements may be located within the helical formation such that the central axes of the locking elements are substantially tangential. In that instance the profile of the helical formation and the

helical groove will conform to the curved configuration of the cylindrical elements. It should be appreciated however, that other shapes (e.g. cubic shapes) of the locking elements may be utilised depending upon the nature of the circumstances.

In addition, while each of the embodiments has been described as having the helical formation on the male member and the helical groove on the female member it is also possible for the helical formation to be located on the female member and the helical groove to be located on the male member if the circumstances so require or permit.

As a result of the embodiment a coupling is provided which can withstand considerable impact and torsional forces but which, due to the relatively small contact area between the male member and female member provided by the locking element, is relatively easily disassembled. The embodiment has particular advantage in the drilling industry to provide for the coupling of drilling components to drill strings and the like. The embodiment also has application as a replacement for standard threaded connections which are subject to high loads such as impellers on large centrifugal pumps, propellers, or shafts and like components.

It should be appreciated that the scope of the present invention need not be limited to the particular scope of the embodiments described above.

THE CLAIMS defining the invention are as follows:

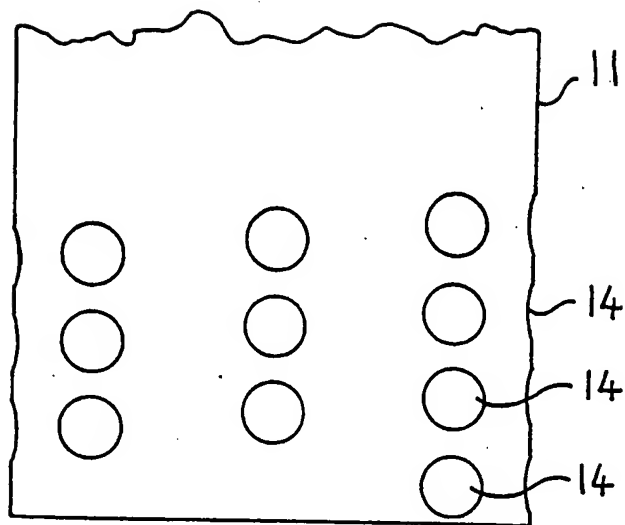
1. A coupling means for fixing a male member of substantially circular cross-section to a female member of complementary configuration, one of said members being formed with a helical groove to be in opposed relation to a correspondingly configured helical formation on the other member when the members are inter-engaged, a plurality of locking elements of substantially complementary configuration to the profile of the helical groove and helical formation being receivable between the helical formation and the helical groove on engagement of the male and female members.
2. A coupling means as claimed in claim 1 wherein the helical formation comprises a helical array of apertures.
3. A coupling means as claimed at claim 1 wherein the helical formation is formed as a continuous helical recess terminating short of the end/or ends of the one member.
4. A coupling means as claimed at claim 1 wherein the helical formation comprises a set of groove shaped recesses.
5. A coupling means as claimed at claim 2, 3 or 4 wherein each locking element is shaped as a ball.
6. A coupling means as claimed at any one of claims 2, 3 or 4 wherein the locking element is cubic in shape.
7. A coupling means as claimed at any one of claims 2, 3 or 4 wherein the locking element is substantially cylindrical in shape.

8. A coupling means as claimed at claim 7 wherein the locking elements are receivable in the helical formation such that their central axes are directed radially.

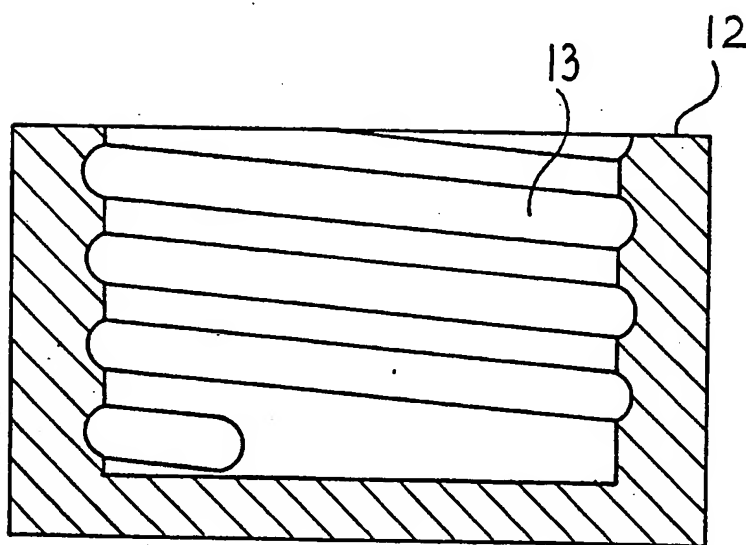
9. A coupling means as claimed at claim 7 wherein the locking elements are receivable in the helical formation such that their central axes are substantially tangential.

10. A coupling means as claimed at any one of the preceding claims wherein a set screw is receivable in the female member to be engagable with one or more locking elements received between the helical groove and the helical formation and the members are substantially fully engaged to clampingly engage the locking element between the male and female members.

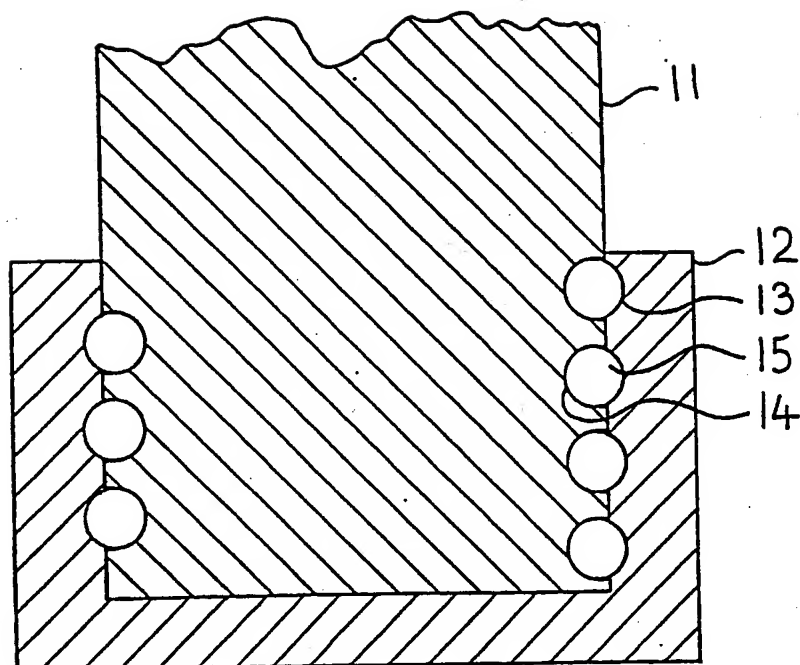
11. A coupling means substantially as herein described.



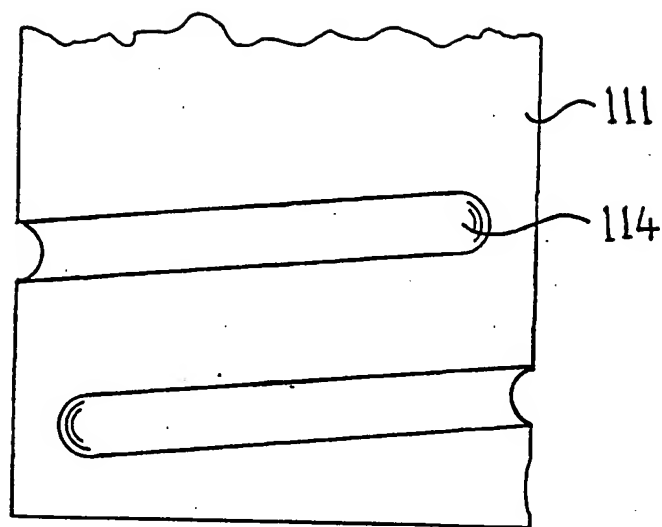
**Fig. 1.**



**Fig. 2.**



**Fig. 3.**



**Fig. 4,**

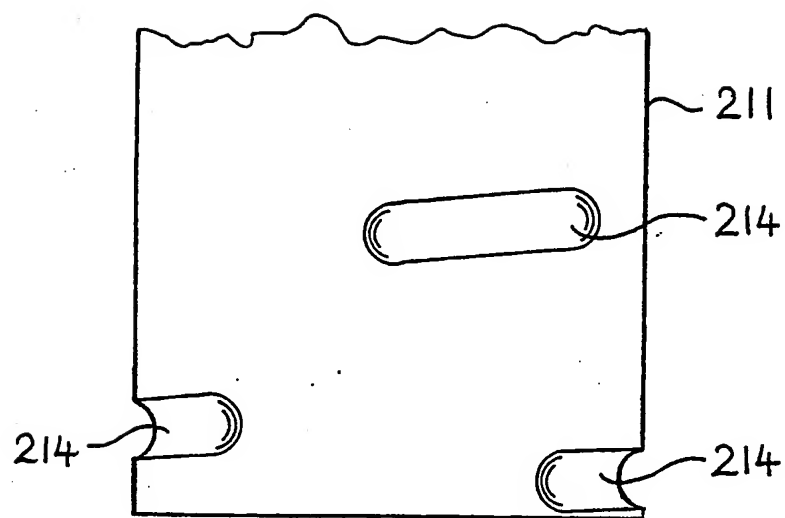


Fig. 5

# INTERNATIONAL SEARCH REPORT

International Application No. **PCT/AU 90/00113**

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) 6				
According to International Patent Classification (IPC) or to both National Classification and IPC				
Int. Cl. <sup>5</sup> F16B 7/18, E21B 17/04, 17/042				
<b>II. FIELDS SEARCHED</b>				
Minimum Documentation Searched 7				
Classification System	Classification Symbols			
IPC	F16B 7/18, E21B 17/04, 17/042			
Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched 8				
AU : IPC as above				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> 9				
Category*	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages 12	Relevant to Claim No 13		
A	GB,A, 1275032 (HEATH & SHERWOOD DRILLING LIMITED) 24 May 1972 (24.05.72) See entire document	(1-11)		
A	US,A, 2150875 (AIRCRAFT SCREW PRODUCTS COMPANY, INC.) 1 March 1939 (14.03.39) See entire document	(1-11)		
A	AU,B, 2219/54 (201262) (RIP BITS LIMITED) 13 November 1955 (13.11.55) See entire document	(1-11)		
A	AU,A, 24874/30 (SCAFFOLDING (GREAT BRITAIN) LIMITED) 22 January 1931 (22.01.31) See entire document	(1-11)		
X	'Illustrated Dictionary of Mechanical Engineering', published 1984, by Martinus Nijhoff, see page 56, figures 4.117 and 4.118 (contd)	(1-9,11)		
<p>* Special categories of cited documents: 10</p> <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width: 50%; vertical-align: top;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </td> </tr> </table>			<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>
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<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search 13 June 1990 (13.06.90)	Date of Mailing of this International Search Report <b>29 June 1990</b>			
International Searching Authority <b>Australian Patent Office</b>	Signature of Authorized Officer  <b>P. WARD</b>			

## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A

GB,A, 264077 (CUTHILL & THE OIL WELL ENG. CO. LTD)  
13 January 1927 (13.01.27) See entire document

(1-11)

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE <sup>1</sup>

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers , because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4 (a):

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING <sup>2</sup>

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

## Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON  
INTERNATIONAL APPLICATION NO. PCT/AU 90/00113

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Patent Document  
Cited in Search  
Report

Patent Family Members

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GB 1275032

CA 863785

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END OF ANNEX

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